POLIOMYELITIS IN TRINIDAD
1971-1972

Written by
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Health Organization

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May 1972

U.S. DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
PUBLIC HEALTH SERVICE
HEALTH SERVICES AND MENTAL HEALTH ADMINISTRATION
CENTER FOR DISEASE CONTROL
EPIDEMIOLOGY PROGRAM
ATLANTA, GEORGIA

INTRODUCTION

On Monday, Jan. 3, 1972, Dr. Pierre Ardoin, Director of the Trinidad Regional Virology Laboratory (TRVL), University of the West Indies, reported to the Center for Disease Control (CDC), Atlanta, Georgia, that since Dec. 6, 1971, his laboratory had isolated type 1 poliovirus from 27 of 48 patients with suspected poliomyelitis in Trinidad.

The next day, L. Schonberger, M.D., of the Viral Diseases Branch, Epidemiology Program, CDC, discussed this outbreak of poliomyelitis in Trinidad with Dr. Mervyn Henry, Chief Medical Officer, Trinidad Ministry of Health. It was agreed that Trinidad was probably on the verge of a major poliomyelitis epidemic and that an ongoing epidemiologic study was needed. A national vaccination campaign, using monovalent type 1 oral poliovirus vaccine and directed at children under 4 years of age was tentatively planned for January 8 and 9. This was subsequently changed to trivalent oral vaccine for children 3 months to 6 years of age. (See Immunization Campaign section). Grammar schools were to be closed following the Christmas-New Year holiday, until a school vaccination program and serologic study could be organized.

A decision was made on January 5, to send Dr. Schonberger to Trinidad under the auspices of the Pan American Health Organization (PAHO) to assist with the poliomyelitis outbreak. Milford H. Hatch, Sc.D., Chief, Enteric Virology Unit, Laboratory Division, CDC, would join Dr. Schonberger to offer laboratory support. They arrived in Trinidad on January 8. Dr. Hatch remained until January 25, and Dr. Schonberger remained until February 6.

DESCRIPTION OF THE AREA

The island of Trinidad and its smaller sister island, Tobago, constitute an independent member nation of the British Commonwealth. The country lies 6 1/2 miles from the coast of Venezuela in the southern Caribbean. The climate is tropical; January to June is dry, and July to December is rainy. Second largest of the former British West Indies, Trinidad is about 65 miles at its greatest width, 50 miles at its greatest length, and has an area of 1,864 square miles. Its 1972 population is 949,200. Approximately 44 percent of the population is of African ancestry, 36 percent East Indian, 2 percent European, 1 percent Chinese, 1 percent Middle-Eastern and 16 percent mixed ancestry. Religions include Roman Catholic (36%), Protestant (34%), Hindu (23%), and Moslem (6%).

There are eight counties consisting of 29 wards plus three major municipalities: Port-of-Spain (population 71,145), San Fernando (population 39,109), and Arima Borough (population 12,363). These three cities and the three wards adjacent to Port-of-Spain and San Fernando constitute the major concentrations of population in Trinidad. The rest of the island is largely agricultural with sugar cane, citrus, copra, and cocoa being most important in terms of dollar value and employment.

The island of Tobago (41,300 population) is northeast of Trinidad, across a channel 19 miles wide, and constitutes a ninth county of the two island nation. Tobago is 32 miles long and 11 miles wide with an area of 116 square miles. Travel between the islands is restricted to those who can afford it. A round-trip fare from Port-of-Spain is $7.00 by boat and $24.00 by airplane. No poliomyelitis cases were reported from Tobago at the time of the epidemic in Trinidad.

The nation's infant mortality dropped from 62 per thousand in 1959 to 37 per thousand in 1968. Its birth rate fell from 39 per thousand to 27.5 per thousand, and its over-all death rate dropped from 14 per thousand to 7 per thousand from 1946 to 1968. In the 3-year period 1965-1968, the average annual population growth was 1.6 percent, representing a significant drop from the 2.9 percent for the period 1946-1960. The population is young; over 50 percent of the people on the island of Trinidad are under 20 years of age, and 35 percent are under 13.

THE HISTORY OF POLIOMYELITIS IN TRINIDAD

Poliomyelitis has existed in Trinidad in endemic form with periodic major outbreaks for at least 35 years. Table 1 shows the incidence of poliomyelitis from 1935 to 1971. Major outbreaks occurred in 1937, 1941, 1942, 1945, 1954 and 1957. In all but five of the 31 other years listed, the number of cases was below 10. The disease has shown a recurrence in serious epidemic form at irregular intervals, ranging from 2 to 14 years. Trinidad's last major poliomyelitis outbreak from February to August 1957, like the present outbreak, was caused by type 1 poliovirus. A total of 300 cases were reported from widely scattered areas throughout the island.

Trinidad's first mass poliomyelitis vaccination campaign was conducted in 1963, stimulated largely by an increase in the number of cases that year. Official reports showed that 234,400 children under 10 years old, or 96.6 percent of the target population, received two doses of trivalent oral vaccine.

The country's second and most recent mass vaccination program was conducted in mid 1967, stimulated by polio outbreaks in neighboring continental South America. A total of 54.9 percent of children 3 months to 5 years of age received at least one dose of trivalent oral poliovirus vaccine, and 41.6 percent received two doses.

Since mid-1967, vaccination has been inadequate. As of December 1971, less than 10 percent of the children in Trinidad born after the 1967 vaccination campaign had received even one dose of poliovirus vaccine from the government. (Data regarding vaccinations by private physicians are not available.)

METHOD OF CASE FINDING

The diagnosis of poliomyelitis was based on either demonstrable flaccid paralysis of acute onset (198 cases) or meningitis and a positive stool culture for type 1 polio (7 cases).

Poliomyelitis cases from all areas of Trinidad were referred to two hospitals, Port-of-Spain General (800 beds) and San Fernando General (700 beds) because other hospitals preferred not to treat them. This made possible a reasonably complete and accurate count of hospitalized cases. Tobago had its own hospital in the city of Scarborough; however, contact with that island every 3 days during the epidemic failed to reveal any new cases.

After arriving in Trinidad, the writer attempted to obtain a complete list of poliomyelitis cases in patients who had already been admitted to the hospitals and set up a centralized surveillance system for identifying new poliomyelitis cases soon after their hospital admission. A list of patients with suspected poliomyelitis was obtained from Dr. Oswald Siung, Principal Medical Officer of Health, who had been regularly calling his own hospital contacts. The diagnoses of the patients were checked and additional cases were identified by interviewing hospital physicians, and reviewing TRVL and hospital records. With the help of M. Henry, M.D., P. Ardoin, M.D., and PAHO Representative Colm O'Colman, headquarters for a surveillance system was established at TRVL equipped with a Trinidad Ministry of Health phone, a PAHO secretary, and Dr. Ardoin's University of West Indies furniture and maps. I. Mohammad, M.D., Chief of Infectious Diseases at San Fernando General Hospital, or his close associate, R. Cox, M.D., Pediatrician, and a surveillance nurse from Port-of-Spain General Hospital called the headquarters daily to report newly identified poliomyelitis cases.

Primarily responsible for identifying new poliomyelitis cases at San Fernando were Dr. Mohammad and Dr. Cox who examined all the suspect cases. At Port-of-Spain, the responsibility was shared by two pediatric consultants, Dr. McDowall and Dr. Ramkissoon, and four medical consultants, Dr. Quamina, Dr. Ince, Dr. Bartholomew and Dr. Ratan. Poliomyelitis case report forms were provided at both hospitals to facilitate collection of the following information: poliomyelitis patient's name, age, sex, home address, date of onset of illness, date first seen, vaccination history, location of paralysis, name of reporting physician.

At both hospitals, though primarily at Port-of-Spain General, the writer reviewed charts and examined patients. Reports of several home visits were collected from Medical Officer of Health, Stella Abidh. By February 6, information on 205 hospitalized poliomyelitis cases had been collected. Chief sources of information on these cases were: a) hospital chart reviews, 123 cases; b) home visit reports, 5 cases; c) hospital report forms, 64 cases; d) initial physician interviews, 11 cases; and e) Trinidad Regional Virology Laboratory reports, 2 cases.

The surveillance system missed some paralytic poliomyelitis patients who were cared for by private physicians outside the hospital. Two such patients were revealed in a survey of 39 out of 237 private physicians in Trinidad on January 13 and 17, when approximately 125 hospitalized poliomyelitis cases had been identified. No regular concerted effort was made to determine non-paralytic poliomyelitis cases.

THE POLIOMYELITIS EPIDEMIC

The date of admission to the hospital was obtained for all 205 patients (Figure 1) and the date of onset for 178. The interval between date of onset and date of admission for these 178 cases is shown in figure 2. By randomly distributing the 27 unknown intervals between onset and hospital admission so that they corresponded to the distribution of the 178 known intervals, an epidemic curve by week of onset was derived (Figure 3).

The first case, as shown in figure 3, occurred in the week ending October 10, 1971. This patient lived in the sparsely populated eastern Trinidad ward of Cocal. The second case was in a 2-year-old boy from Laventille who became ill in the week ending November 21. Laventille (21,000 population) is a poor working class district of St. Ann's Ward near the city of Port-of-Spain. Neither of the first two poliomyelitis cases nor their close contacts had recently traveled more than several miles from home. In the next 2 weeks, November 22-December 5, 10 more children had onset of poliomyelitis who were subsequently hospitalized. Eight of them lived in Laventille or adjacent areas, and two lived in eastern Trinidad. The first type 1 polioviruses of the epidemic were isolated from stool specimens from seven of these cases. Through the week ending January 2, the number of cases steadily increased, and then rose sharply in the week ending January 9. The epidemic peaked in the following week.

Of the 46 patients who became ill before December 27, 33 lived in St. Ann's Ward or adjacent Port-of-Spain (Figure 4). The more rapid increase in new cases (108) seen from December 27 to January 16 represented both an increase in the number of new cases in most of the previously affected areas and a spread of the disease throughout the island (Figure 5). Areas reporting cases for the first time between December 27 and January 16

included Arima Borough, Manzanilla, San Fernando, LaBrea, Erin, Naparima, and Moruga. Of these Manzanilla, Naparima, and Moruga reported three or more cases. The largest number of new cases (27) continued to come from St. Ann's Ward.

In the 3-week period January 17-February 6, the epidemic waned (51 new cases). In contrast to the early spread of the disease, most of these cases came from Siparia Ward in the South rather than from St. Ann's Ward. Couva, Montserrat and Arima Wards reported cases for the first time, while no new cases came from Laventille, Manzanilla, or Charuma (Figure 6).

The overall attack rate per 100,000 population was 21.6. Cocal, Laventille, and Moruga had considerably higher attack rates per 100,000 than the other areas of the country, 92.6, 90.5, and 57.7 respectively. Cocal and Moruga are sparsely populated wards in the southern half of Trinidad, in contrast to Laventille which is a densely populated district of northern Trinidad. The area with the fourth highest attack rate, Charuma ward (40.9 cases per 100,000 population), lies adjacent to Cocal ward and is also relatively sparsely populated. The largest number of cases, whether or not Laventille is included, lived in the most densely populated ward in Trinidad, St. Ann's (Figure 7).

Patients ranged in age from 5 weeks to 33 years (mean, 3 years). Over 75 percent of the cases were in persons less than 7 years of age, and over 90 percent of the cases were less than 13 (Figure 8). By February 6, type 1 poliovirus had been isolated at TRVL from 99 of 152 patients. The age distribution of those with positive cultures is shown in figure 8. Age specific attack rates are shown in table 2. Relative to the youngest age group, the attack rate was approximately 1/5 as great for the 7 to 12-year-olds, 1/11 as great for the 13 to 18 year-olds, and 1/55 as great for those 19 years and older. The male and female-specific attack rates per 100,000 population were 23.9 and 19.4 respectively (Table 3). Males predominated in all age groups except the 13 to 18-year-olds. Of the 205 poliomyelitis cases identified, 46.3 percent had East Indian surnames. Since approximately 44 percent of the population in Trinidad have East Indian surnames, the overall data shows no significant predilection of this group for the disease.

Primarily by reviewing hospital charts at Port-of-Spain General, the investigator obtained information on the prodromal symptoms of 126 patients. The most common symptoms were fever (94.4%), vomiting (36.5%), coughing (24.6%), headache (21.4%), muscle aches (15.9%), and stiff neck (10.3%).

Eleven patients (5.4%) were known to have bulbar disease, and four died. Five of these had paralysis of a seventh cranial nerve, and four had paralysis of a tenth cranial nerve. One patient was reported to have vaso-motor involvement, and another respiratory center involvement.

Eleven of the 205 hospitalized poliomyelitis patients died (case fatality ratio, 5.4%). Ten of the deaths were in the 0-6 year age group (case fatility ratio, 6.5 percent), and one of the deaths occurred in the ≥ 19 year age group (case fatility ratio, 12.5%). The diagnoses of poliomyelitis was confirmed by virus isolation for eight of the 11 fatalities. Type 1 poliovirus was isolated from brain tissue from two fatal cases, including the one adult. The immediate cause of death was noted in nine of the 11 cases. Seven had primary respiratory failure, one bulbar shock, and another pneumonia complicating respiratory insufficiency.

An interesting feature of this epidemic was the marked difference in the distribution of cases by race and age between the northern and southern parts of Trinidad. (The arbitrary border between North and South Trinidad is a line made by the northern borders of Couva, Montserrat, Charuma and Cocal Wards. The South comprises 54.2 percent of the Island, but has only 43.4 percent of the population.) A total of 62 of 84 poliomyelitis cases in the South (73.8%) had East Indian surnames, compared with 33 of 121 cases in the North (27.3%). Poliomyelitis cases by age for northern and southern Trinidad is shown in table 4. The accuracy of the age specific attack rates depends on the assumption that the age distribution of the population in the two sections of the country are the same. Attack rates for the North and South were significantly different for every age group except adults ≥ 19 years of age.

The age distributions of poliomyelitis cases among East Indians and others in the South were more similar to each other than they were to the age distributions of poliomyelitis cases in either group in the North. In other words, location of residence rather than race correlated better with the age distribution of the poliomyelitis cases.

DISCUSSION

The progression of the poliomyelitis epidemic in Trinidad suggests that national holidays may pose a potential danger to the containment of small poliomyelitis outbreaks. It was probably no coincidence that the major spread of the epidemic occurred during a poliomyelitis incubation period (3-21 days) after Christmas. During the holiday period, buses and cars were filled with people traveling throughout the Island to visit friends and family. At least four of the patients from four different wards in Trinidad became ill several days after visiting together over the Christmas vacation. The father of a fifth poliomyelitis patient with onset January 8, visited over the Christmas vacation, the home of another child who had been ill with poliomyelitis for 1 day.

Assuming that the calculated age specific attack rates in North and South Trinidad are correct, and that bias in the surveillance system was small, the higher attack rate for the children under 7 in the North appears to reflect the earlier more rapid urban spread of the epidemic there and the subsequent greater protection of children in the South by vaccinations. (See Campaign Effectiveness section)

The higher attack rates in the South among the children 7-12 and 13-18 suggest that the mass vaccination programs in 1963 and 1967, which provided two doses of oral poliovaccine to 96.6 percent and 41.6 percent of the target populations respectively, was less successful in the South than in the North. The present ages of children vaccinated in the 1963 and 1967 campaigns would be 9 1/4 to 18 years, and 5 1/4 to 9 years respectively. With the tropical heat of Trinidad, the greater time needed to transport vaccine from the government's central vaccine stores to the southern population, and the inadequate supply of freezers in the South, a greater use of spoiled vaccine in previous vaccination campaigns in the South relative to the North would not be unexpected. The frequent need for guidance in the storage of vaccine in the present vaccination campaign led to the Ministry of Health publishing recommendations written by Dr. M. Hatch.

Appropriate denominatior data is not available from the government for analysis of the distribution of the poliomyelitis cases with East Indian surnames. The higher proportion of these cases in the South, however, probably reflects to a large degree the distribution of East Indians in the country as a whole. According to a Trinidad government official, East Indians comprise a greater proportion of the agricultural workers than city workers in Trinidad. The greater number of poliomyelitis cases in East Indians in the South, therefore, might also indicate a rural location of the epidemic there.

IMMUNIZATION CAMPAIGN

A vaccination program had been planned to start December 22 in St. George County and Port-of-Spain, but it was not successful because of an unaroused public, inadequate vaccine supplies, and the Christmas holidays. The first national campaign was started on January 8, with approximately 800 people staffing over 300 vaccination centers. Children ages 3 months to 6 years, who were considered to be at highest risk, were selected as the initial target population. By January 10, 89,499 or 55.6 percent of the target population in Trinidad received one dose of oral poliovirus vaccine. This figure was raised to 81.5 percent after a "wrap up" vaccination campaign for this age group was conducted January 22 and 23.

The Ministry of Health chose trivalent, rather than monovalent oral poliovirus vaccine, because of the frequent isolation of type 2 poliovirus prior to the epidemic. Though there were less than 1,000 doses of oral vaccine in government stores on December 22, the Ministry of Health obtained 140,000 doses of trivalent and 25,000 doses of monovalent oral poliovirus vaccine by January 7 and an additional 410,000 doses of trivalent vaccine on January 8. Vaccine received January 8 was distributed immediately to local health centers by Ministry of Health personnel who worked throughout the night.

A campaign for the 7 to 12 year-olds was conducted from January 13 to January 18 at temporarily opened schools. This campaign reached 138,507 children or 84.3 percent of the target population.

Beginning January 27, the Medical Officers of Health in the South vaccinated the 12 to 18 year olds in schools, and were followed by the Medical Officers of Health in the North who vaccinated this age group during the first week in February. Adults meanwhile were offered vaccine at the local health centers. Based on the information available February 6, 1972, the percentage of target populations who received vaccine by various dates is listed in table 5. The numbers do not include vaccinations performed by private physicians.

Thirty-nine of Trinidad's 237 practicing physicians submitted completed questionnaires on January 13 and January 17 stating that they had vaccinated 19,963 individuals of all ages since the beginning of the epidemic. If this sample were representative, an estimated 2 percent of Trinidad's population was recently vaccinated by private physicians. The vast majority of these vaccinations were, presumably, in middle and upper income children and adults who elected not to wait for government provided vaccine.

CAMPAIGN EFFECTIVENESS

After the government's national vaccination campaign, there was a rapid decline in the total number of reported new cases (Figures 1 and 3). The attack rate for children from 3 months to 6 years of age who had been vaccinated by the government between December 22 and January 10 fell sooner and more rapidly than the attack rate for those who were not vaccinated in this period (Figure 9). In the second week after this vaccination campaign, the attack rate for the unvaccinated children was 17.6 per 100,000, compared with 5.6 for the vaccinated children. This supports the contention that the mass vaccination program using primarily trivalent oral poliovirus vaccine effectively curtailed this type 1 poliomyelitis epidemic.

The effectiveness of the initial mass vaccination campaign January 8-10 in South Trinidad was greater than in North Trinidad. The campaign in the South reached a higher percentage of the target population, 66.7 percent compared with 47.0 percent. This probably resulted because over 75% of the vaccination centers were established in the South due to different strategies among Medical Officers of Health. Furthermore the campaign in the South relative to the epidemic in the South was conducted earlier than the campaign in the North relative to the epidemic there (Figure 10 and 11). The 6723 vaccinations completed by January 10 in Caroni County were arbitrarily

divided between North and South in the same proportion as the division of its population. Of the 107 poliomyelitis cases in North Trinidad under 7 years of age, two younger than 3 months and a 2-year-old child with an unknown vaccination history were not included in figures 9 and 11.

The effectiveness of the initial vaccination campaign is probably underestimated since the denominator of the vaccinated group does not include the children vaccinated by private physicians (figures 9, 10 and 11). In addition, many children not vaccinated in the government's initial campaign were protected by vaccinations given later.

RECOMMENDATIONS

1. The Ministry of Health should work towards vaccinating its infant population on routine visits to well-baby clinics. To achieve this, the Ministry needs to acquire more trained personnel, to supply and maintain improved equipment (such as freezers for its clinics), and most importantly to increase and maintain an ongoing educational campaign emphasizing the importance of the free services offered at the well-baby clinics in Trinidad.

2. If routine vaccinations reach less than 75 percent of the infants in the population, then Trinidad should consider having at least two week-end mass campaigns each year, with an interval of not less than 6 weeks between each, in which all children between the ages of 2 months and 3 years receive trivalent oral poliovirus vaccine.

If insufficient numbers of parents bring their children to vaccination centers during mass campaigns, then Trinidad should consider house-to-house vaccinations utilizing community volunteers. This recommendation should be received with the understanding that the minimum percentage of the infant population in Trinidad who must be vaccinated in order to prevent another poliomyelitis epidemic is not known.

3. Legislation requiring immunization against poliomyelitis prior to school entry is recommended.

4. The positions of Medical Officers of Health are extremely important in Trinidad and immediate steps to attract newly trained people to the present vacancies should be given high priority.

5. A more uniform and disciplined reporting system for poliomyelitis (and other reportable diseases) should be established.

6. Simple, but regular surveillance reports from the Ministry of Health summarizing the available information on poliomyelitis and other reportable diseases should be sent to the Medical Officers of Health and to private physicians.

7. The basic population statistics at the Ministry of Health should be kept up to date and distributed to the Medical Officers of Health on a regular basis.

8. The Ministry of Health should offer greater support and take greater advantage of the Trinidad Regional Virology Laboratory. The Chief Medical Officer should be appraised regularly of information gathered through this source.

9. To evaluate the poliomyelitis immunologic status of Trinidad's population, regular serologic surveys should be conducted in cooperation with TRVL.

10. Contingency plans for increasing and or reassigning Ministry of Health personnel for possible future epidemic situations should be made.

11. More resources, such as more physical therapists and physical therapy equipment, should be provided for the long range treatment of the poliomyelitis patients.

RECOMMENDATIONS FOR THE PAN AMERICAN HEALTH ORGANIZATION (PAHO)

1. Trained technicians should routinely accompany respirators supplied to a country with a poliomyelitis outbreak, unless there is overwhelming evidence that the technicians will not be needed. The technicians should be capable of instructing others in the use of the machines.

2. PAHO should provide written information on the use and storage of poliovirus vaccine to countries experiencing poliomyelitis epidemics.

3. PAHO should publicize poliomyelitis vaccination requirement guidelines for international travel from epidemic areas to potentially susceptible non-epidemic areas.

4. PAHO should establish a regional store-house of vaccine located at the TRVL in order to avoid the delays caused by international negotiations whenever vaccine is needed in the Southern Caribbean area and to avoid important lapses in availability of vaccine. Furthermore, TRVL should test stored vaccines to assure their potency.

TABLE 1

OFFICIALLY REPORTED POLIOMYELITIS
CASES BY YEAR, TRINIDAD
1935 to 1971

YEAR	CASES	YEAR	CASES
1935	5	1953	2
1936	6	1954	189
1937	106	1955	16
1938	9	1956	9
1939	5	1957	300
1940	3	1958	27
1941	59	1959	15
1942	135	1960	3
1943	9	1961	3
1944	4	1962	12
1945	99	1963	15
1946	5	1964	4
1947	5	1965	0
1948	8	1966	1
1949	8	1967	3
1950	1	1968	1
1951	3	1969	9
1952	6	1970	3
		1971	2

Table 2
POLIOMYELITIS CASES, BY AGE GROUPS,
TRINIDAD, 1971-1972

AGE	NUMBER OF CASES	AGE SPECIFIC ATTACK RATES
0-6	154	92.2
7-12	31	18.9
13-18	12	8.66
≥ 19	8	1.67
TOTAL	205	21.6

Rate per 100,000 pop.

Table 3
POLIOMYELITIS CASES, BY
SEX AND AGE GROUPS,
TRINIDAD, 1971-1972

AGE	SEX	
	MALE	FEMALE
0-6	79	75
7-12	21	10
13-18	4	8
≥ 19	8	0
TOTAL	112	93
Sex specific attack rates per 100,000	23.9	19.4

Table 4
POLIOMYELITIS CASES, BY AGE GROUPS,
NORTH AND SOUTH TRINIDAD, 1971-1972

AGE GROUPS	NORTH TRINIDAD		SOUTH TRINIDAD	
	CASES	ATTACK RATE*	CASES	ATTACK RATE*
0-6	107	113	47	64.8
7-12	9	9.69	22	30.9
13-18	2	2.55	10	16.6
$\geq$ 19	3	1.11	5	2.40
TOTAL	121	22.5	84	20.4

*Assumes age distributions of populations in North and South Trinidad are the same.

Rate per 100,000 pop.

Table 5
PERCENTAGE OF TARGET POPULATION WHO RECEIVED
VACCINE BY DATE, TRINIDAD, 1972

AGE GROUPS	DATE	NUMBER VACCINATED	PERCENTAGE VACCINATED
	Jan 10	89,499	55.6
3 mos.-6 yrs.	Jan 23	131,261	81.5
	Jan 29	132,080	82.0
7 yrs.-12 yrs.	Jan 18	138,507	84.3
	Jan 30	139,651	85.0

Figure 1 POLIOMYELITIS CASES, BY WEEK OF ADMISSION TO HOSPITAL, TRINIDAD, NOVEMBER 1, 1971 - FEBRUARY 6, 1972

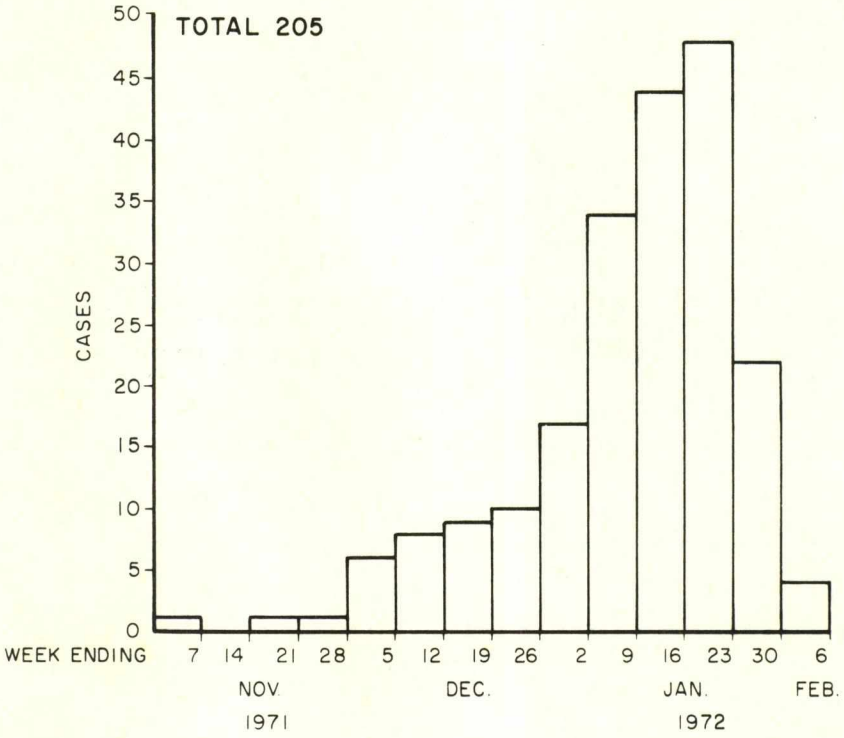


Figure 2 POLIOMYELITIS CASES, BY INTERVAL BETWEEN ONSET AND HOSPITAL ADMISSION, TRINIDAD, OCTOBER 6, 1971 - FEBRUARY 6, 1972

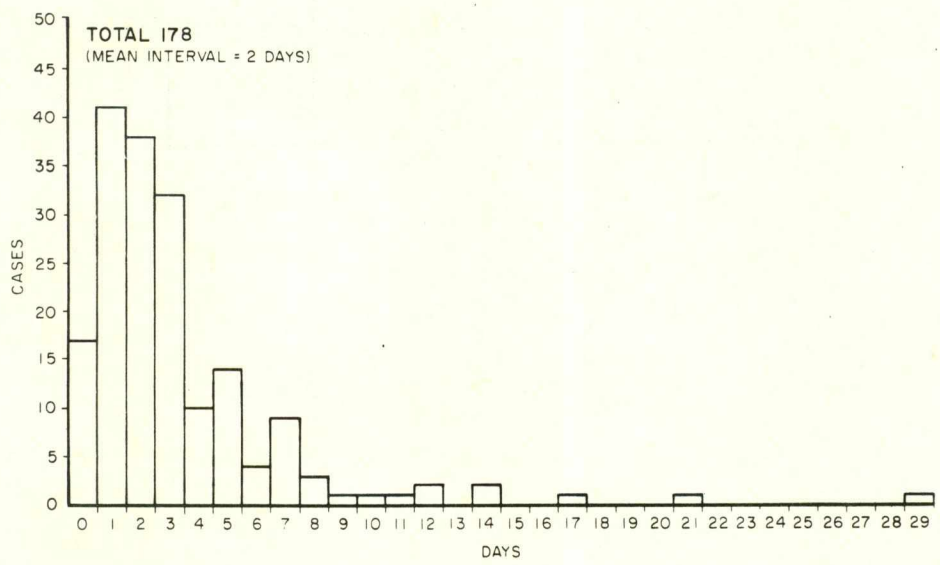


Figure 3 POLIOMYELITIS CASES, BY WEEK OF ONSET, TRINIDAD, OCTOBER 6, 1971 - FEBRUARY 6, 1972

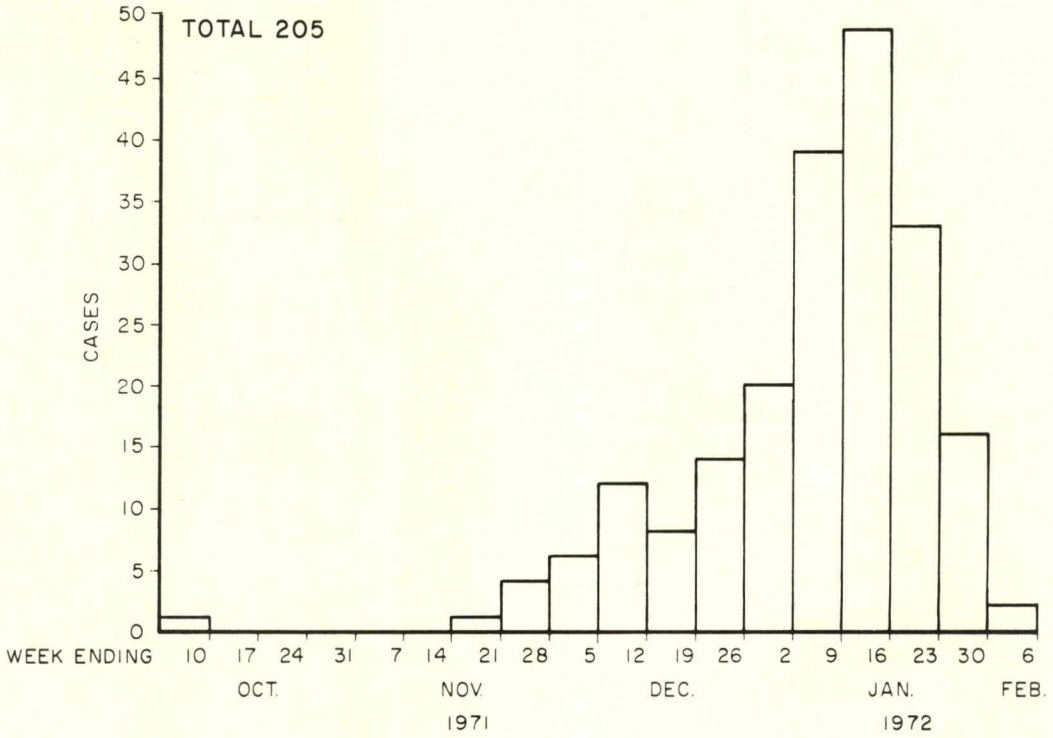


Figure 4 ONSETS, OCT. 6 - DEC. 26, 1971

TOTAL - 46

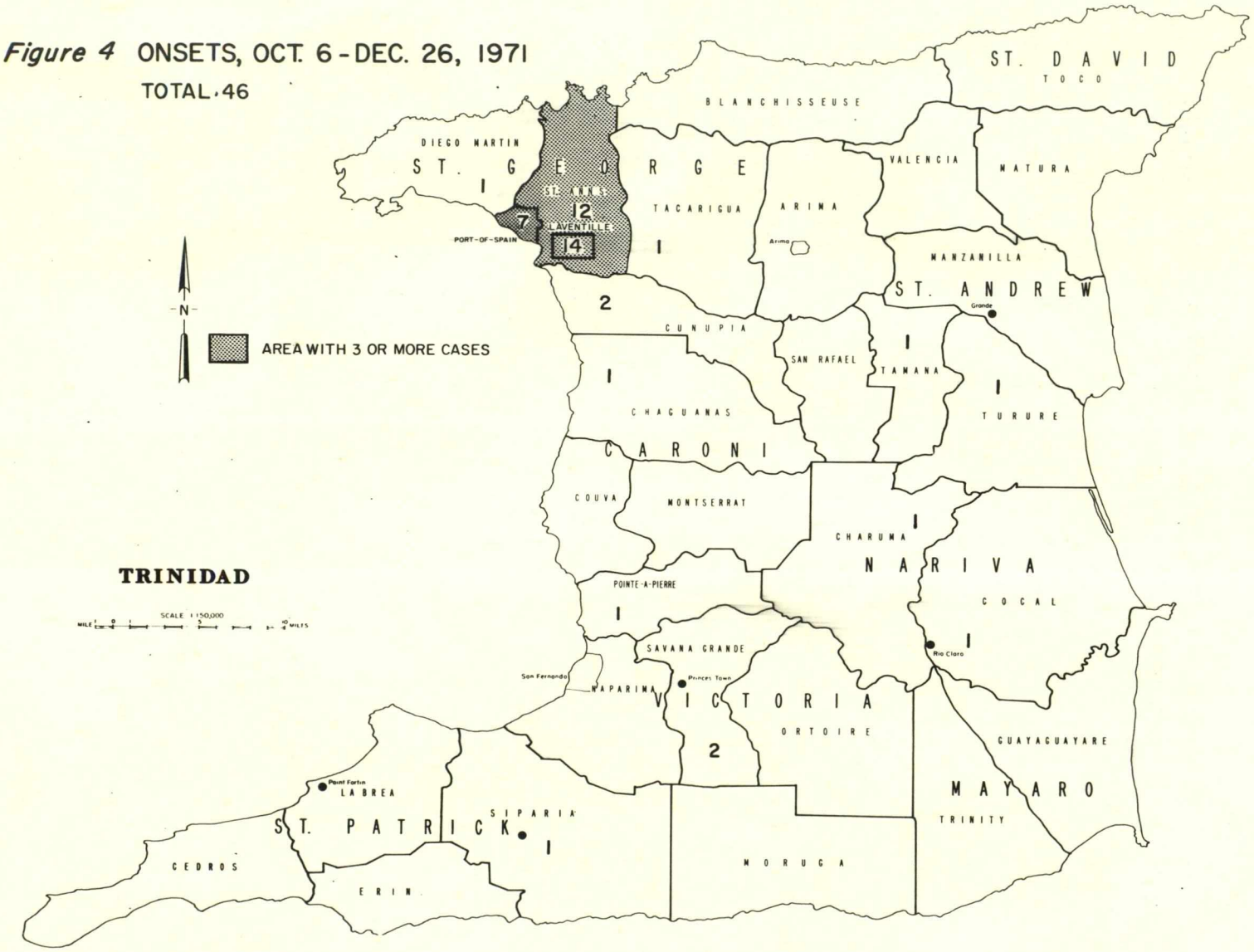


Figure 5 ONSETS, DEC. 27, 1971 - JAN. 16, 1972
TOTAL 108

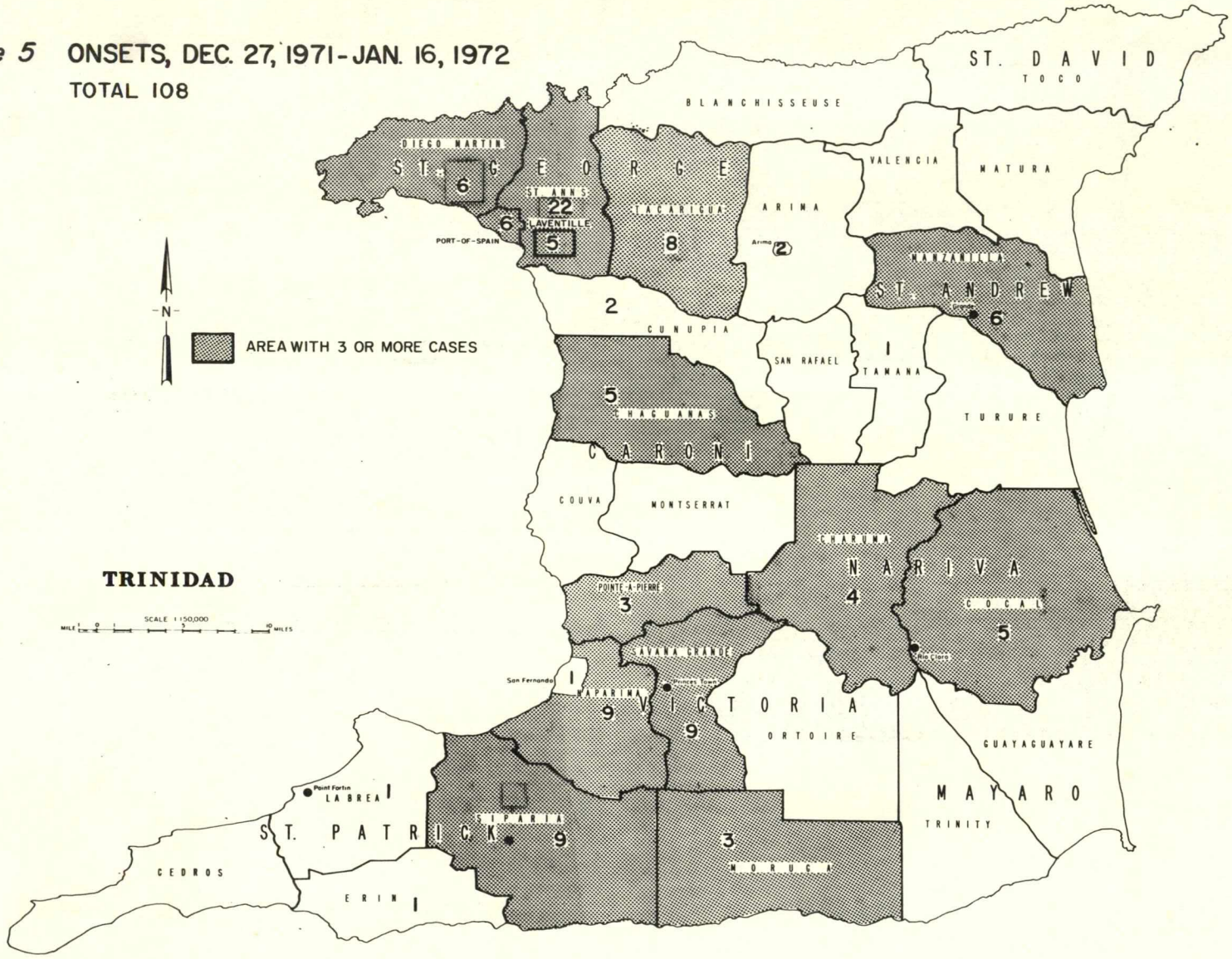


Figure 6 ONSETS, JAN. 17 - FEB. 6, 1972

TOTAL 51

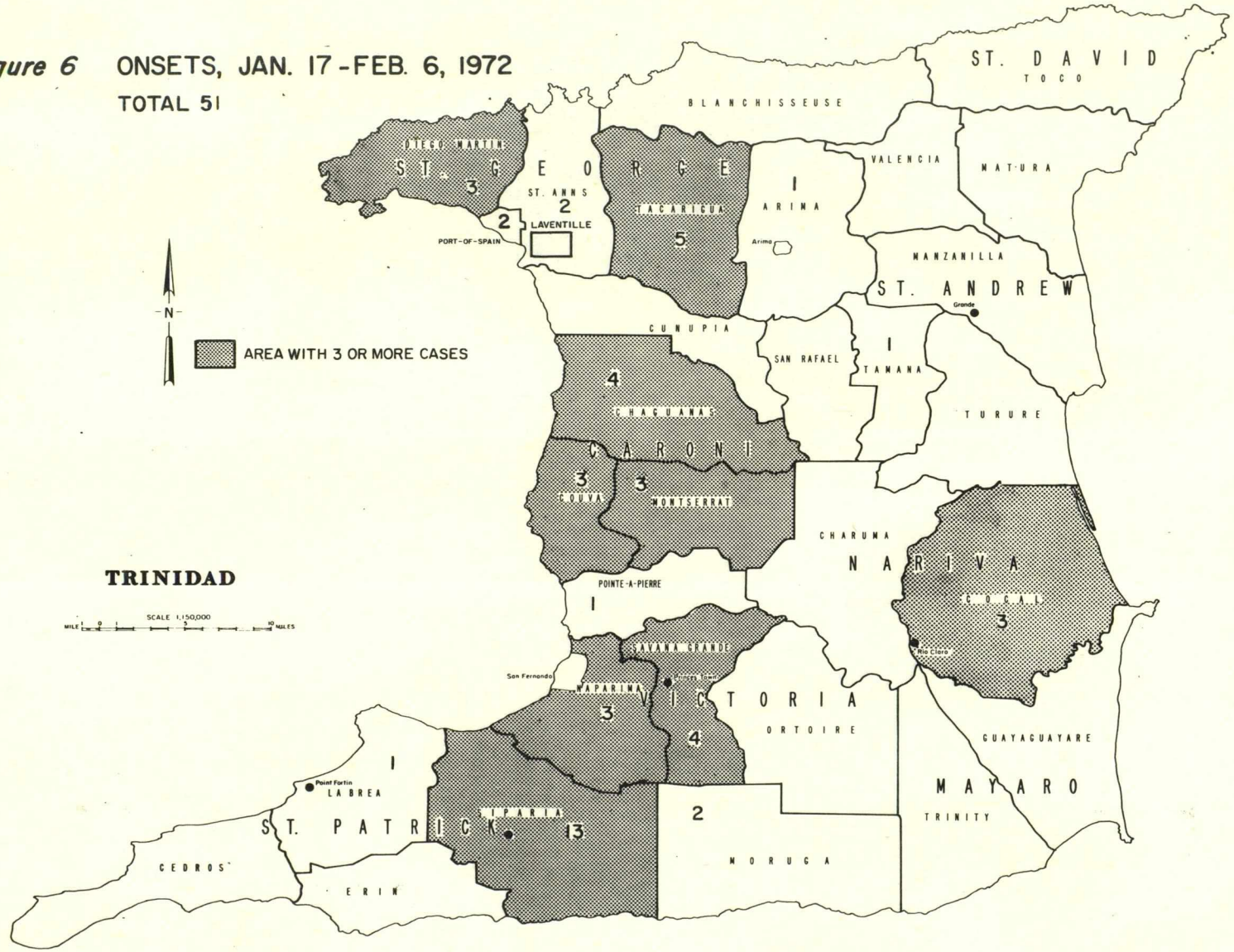


Figure 7 ONSETS, OCT. 6, 1971 - FEB. 6, 1972
TOTAL 205

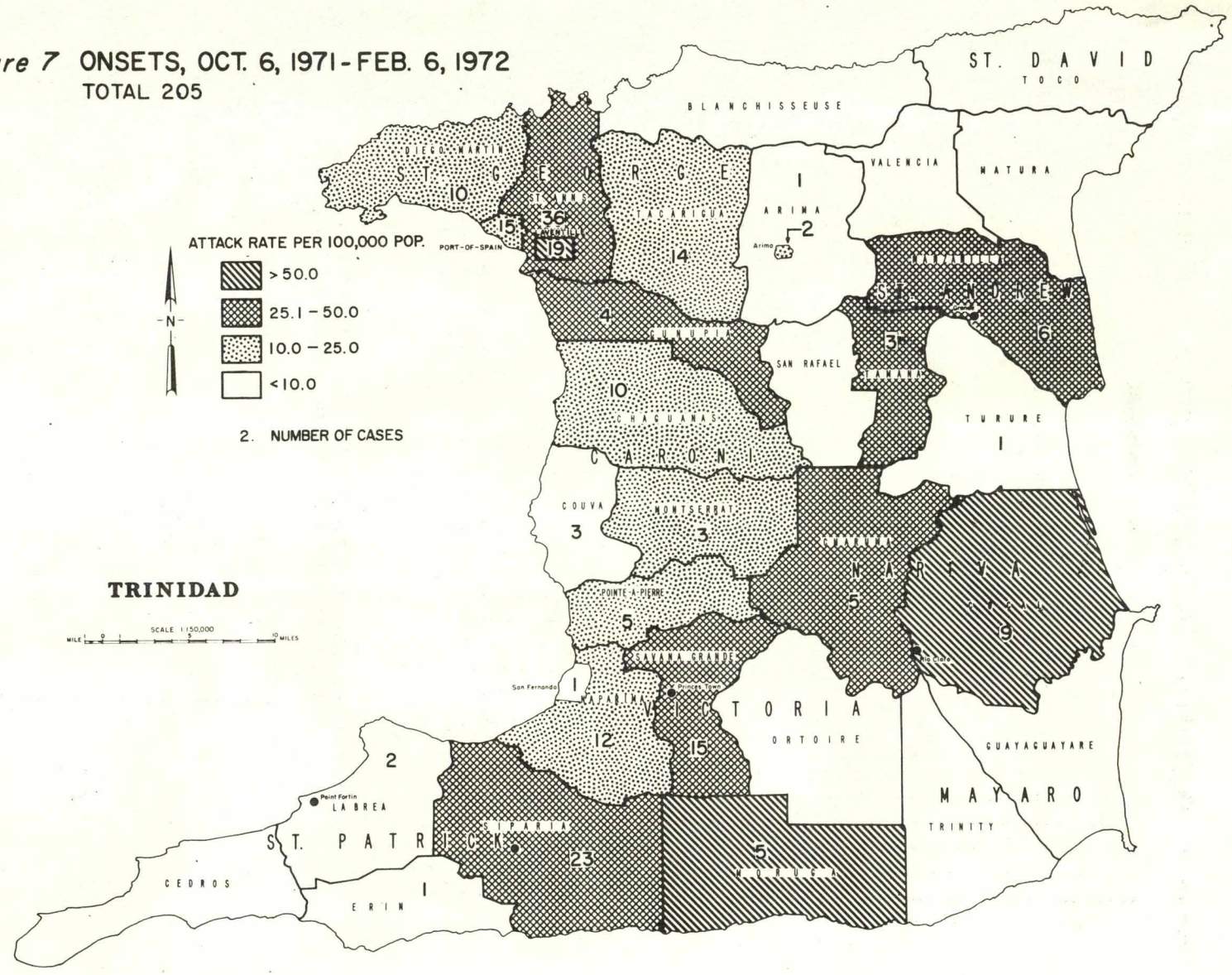


Figure 8 POLIOMYELITIS CASES, BY AGE, TRINIDAD, OCT. 6, 1971-FEB. 6, 1972

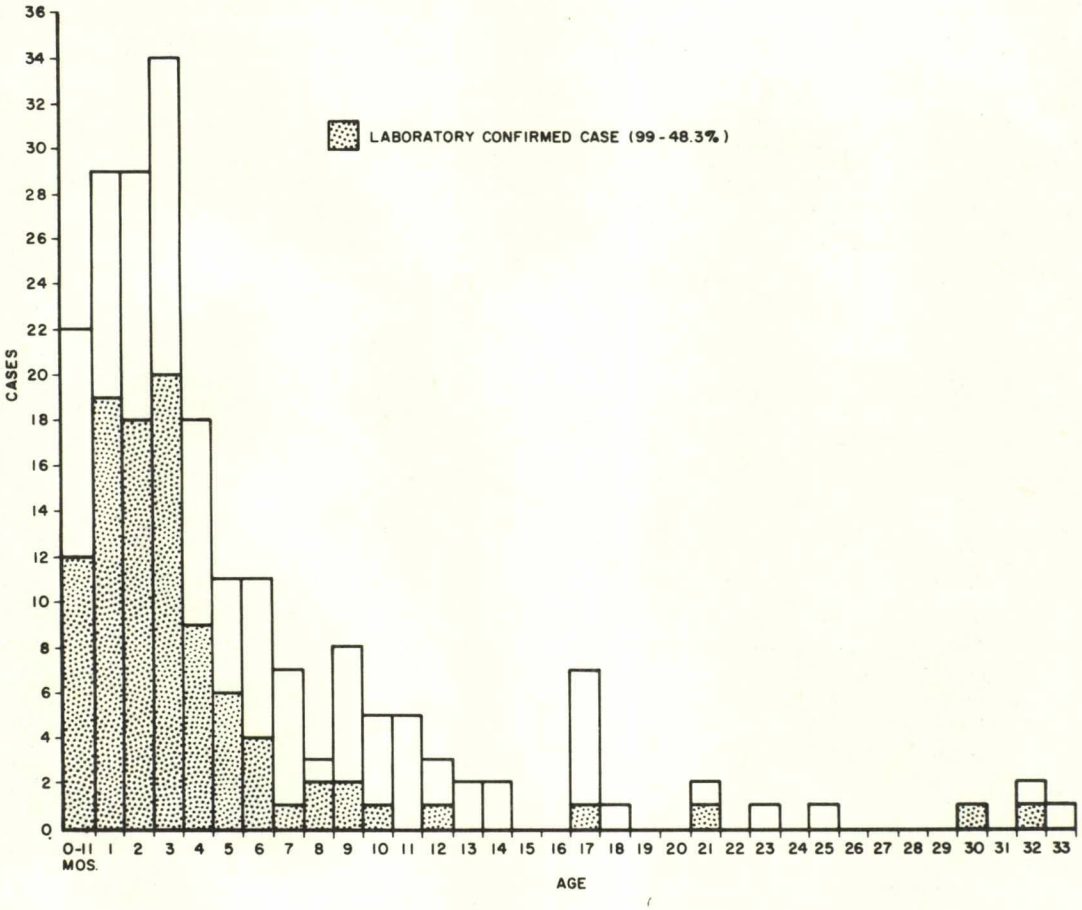


Figure 9 POLIOMYELITIS AGE SPECIFIC ATTACK RATES IN 3 MOS. — 6 YEAR OLDS, BY WEEK, TRINIDAD, NOV. 8, 1971-JAN. 31, 1972

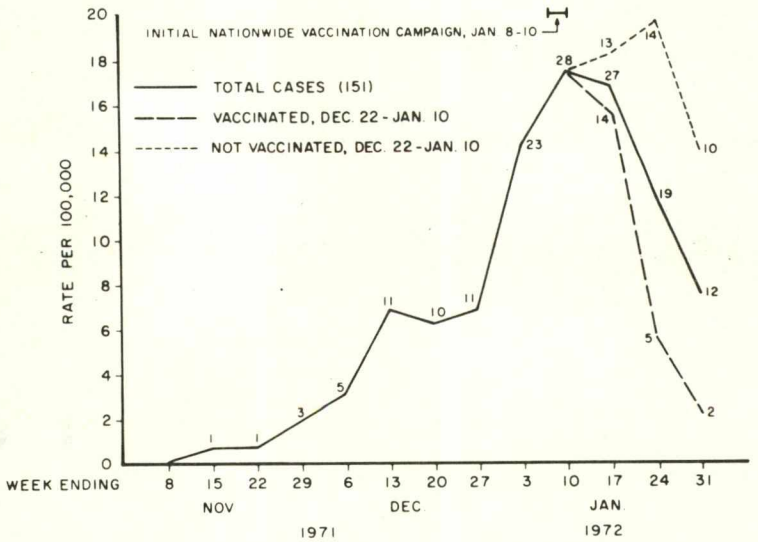


Figure 10 POLIOMYELITIS ATTACK RATES IN 3 MOS. — 6 YEAR OLDS, BY WEEK, SOUTH TRINIDAD, NOV. 8, 1971-JAN. 31, 1972

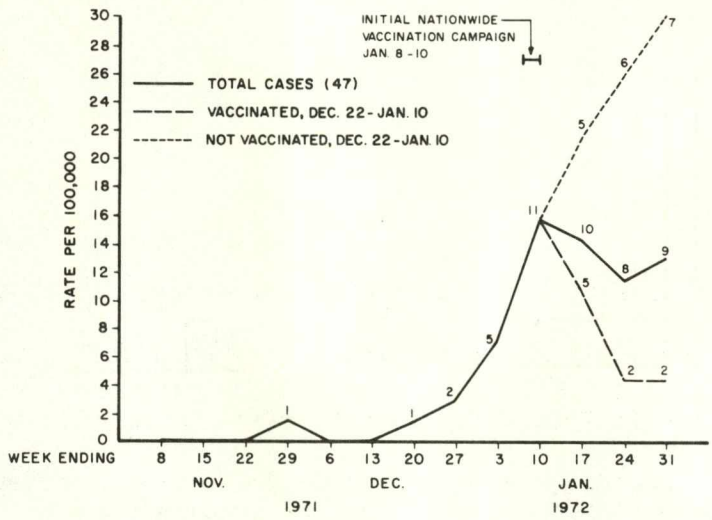
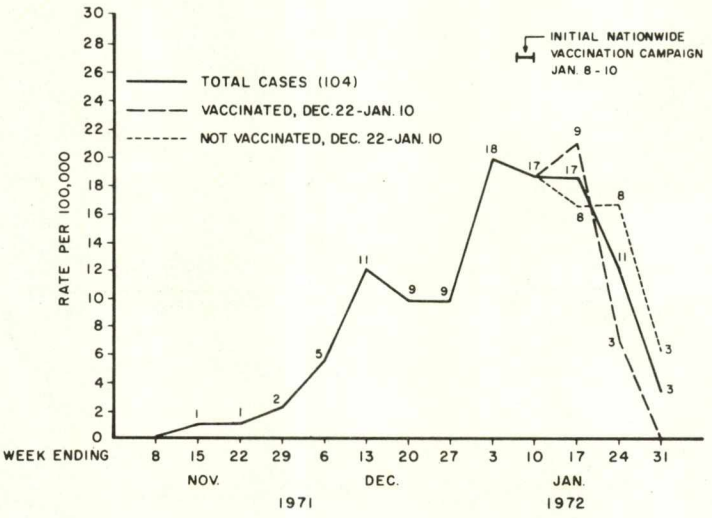


Figure 11 POLIOMYELITIS ATTACK RATES IN 3 MOS. — 6 YEAR OLDS, BY WEEK, NORTH TRINIDAD, NOV. 8, 1971-JAN. 31, 1972



I wish to thank Dr. Pierre Ardoin, Dr. Mervyn Henry, and Dr. Colm O'Colman and their wives for their warm hospitality shown to me during my stay in Trinidad. This hospitality and the energetic co-operation I received, especially from Dr. Ardoin, was essential to the epidemiologic investigation. I wish also to offer special thanks to Nurse Bishop and Mr. Greene of Dr. Ardoin's staff for the long hours they spent collecting and labeling laboratory specimens.

VIROLOGICAL STUDIES

A. Performed at the Trinidad Regional Virus Laboratory (TRVL), Port-of-Spain, Trinidad.

Fifteen of the 30 polioviruses isolated by the Government Diagnostic Virus Laboratory (GDVL) and the TRVL up to the time of our arrival in Trinidad were tested by the neutralization method against poliovirus types 1, 2, and 3 antisera brought from the Center for Disease Control in Atlanta. All 15 viruses were confirmed as poliovirus type 1. One poliovirus isolant previously made at TRVL and identified as a type 2 virus was confirmed as a type 2 with antisera brought from Atlanta.

Eight rectal swabs submitted to TRVL for viral isolation studies were processed by a simultaneous isolation and identification procedure for polioviruses, using primary rhesus kidney tissue cultures. Two specimens yielded poliovirus type 1 (one on the 4th day after inoculation, one on the 5th day). A third specimen yielded a virus which required further tests for identification.

Samples of brain and spinal cord from two fatal cases diagnosed as poliomyelitis were studied by a special agar overlay isolation technique using HEp-2 tissue culture. Plaques were observed with all the specimens. Viruses were isolated from the plaques, passed in primary rhesus kidney cultures and typed by neutralization tests as poliovirus type 1.

Tests were carried out to gain a preliminary idea of the incidence of neutralizing antibody to poliovirus type 1 in school age children. Forty-six pairs of sera (92 total sera) from children ages 6 to 14 years from different parts of Trinidad were tested for poliovirus type 1 neutralizing antibody at 1:8 serum dilution using HEp-2 tissue cultures. Initial sera were collected for previous TRVL studies; the second sera were collected during the time of the poliomyelitis outbreak by TRVL personnel. Results are shown in Table 1.

In the tests of the sera from Vega de Oropouche school, the test dose of poliovirus type 1 was too high ($1000TCID_{50}$). This probably depressed the number of individuals showing antibody in this group. However, in the Vega de Oropouche group tested, there were 8 children 10 years of age or less. Only 2 of these children showed antibody, whereas 7 of 10 children 11 years of age or more had type 1 antibody. Thus, the results in the Vega de Oropouche school children may have been weighted by the inclusion of the younger age group.

Sera studied at the TRVL in 1963-64 (1964-65 Annual Report) indicated an incidence of poliovirus type 1 antibody of about 70% in 10 year olds. Excepting the younger age group in the Vega de Oropouche school, 70%, 67%, and 56% of the groups of children studied here showed poliovirus type 1

Table 1. Results of Serological Tests on Sera from School Children in Trinidad

Location	Age Range	Number Individuals with Antibody to P1*		Number Individuals without Antibody to P1*		Number Individuals Converting**	Number Tested
Vega de Oropouche Government School	6-14	9	(50%)	9	(50%)	2	18
Plum Mitan Presby. Sch. Plum R. Presby. Sch. Grosvenor Presby. Sch.	9 to 13	8	(67%)	4	(33%)	2	12
Tabaquite R. C. Sch. Caparo R. C. Sch.	10-14	9	(56%)	7	(44%)	1	16
TOTAL		26	(56%)	20	(44%)	5 (11%)	46

* Antibody or no antibody at 1:8 serum dilution.

** Number of individuals developing poliovirus type 1 antibody between time of taking of first and second bloods.

antibody (median ages of these groups, excluding the younger group just indicated, were 12, 11, and 12 years, respectively). These results seem generally comparable to the earlier TRVL results, although studies of larger numbers of children in the various age groups would be necessary for more precise data.

B. Performed at the Center for Disease Control (CDC), Atlanta, Georgia.

Twelve original rectal swab extracts found by TRVL to contain a poliovirus (10 type 1, 2 type 2) were studied at CDC to attempt to confirm the original results. All 10 poliovirus type 1 isolations and typings were confirmed. One extract which had yielded poliovirus type 2 at TRVL was found to contain poliovirus type 3 at CDC (TRVL No. 115220). A second extract from which type 2 virus was recovered at TRVL failed to reveal any virus at CDC (TRVL No. 115049). The TRVL isolant from this extract had been confirmed in Trinidad as a poliovirus type 2 with reagents from Atlanta as indicated above. The discrepancy between TRVL and CDC on the one extract yielding type 2 and type 3, respectively, cannot readily be explained. The failure to isolate type 2 virus from the other extract at CDC could have been due to inactivation of virus in storage and transport. All 12 of the rectal swab extracts were negative following inoculation of less than 24 hour old mice.

Thirty-five tissue culture isolants from GDVL-TRVL were passed in primary rhesus kidney tissue cultures at CDC and set up against poliovirus antisera to attempt to confirm typings done at GDVL-TRVL. Thirty-two of these isolants were confirmed as poliovirus type 1. Results on the remaining three were:

	TRVL	CDC
TRVL NO. 115518	Poliovirus type 1	Poliovirus type 3
TRVL No. 115459	Poliovirus type 1	Poliovirus type 2
TRVL No. 115793	Poliovirus type 1	no virus recovered.

No ready explanation can be offered for the two discrepancies in typing. Failure in Atlanta to recover virus from one TRVL tissue culture could have been due to inactivation of virus during storage and transport.

Viral isolation studies were repeated on the central nervous system tissue from the two fatal cases, using fresh pieces of each tissue. Fluid tissue culture, agar overlay tissue culture and suckling mice (<24 hours old) were used to test each specimen. Results are shown in Table 2.

Only poliovirus type 1 was isolated from these two cases. Fecal material on the two patients also yielded this virus. The agar overlay technique allowed isolation of poliovirus type 1 from some tissues where fluid tissue culture methods failed to reveal the virus. Isolation of only poliovirus type 1 from the central nervous system tissues of these two cases both in Trinidad and in Atlanta proves that this virus was the cause of death.

Table 2. Results of Viral Isolation Studies on Central Nervous System Tissues of Fatal Cases of Poliomyelitis

Case Number	Specimen	Fluid Rhesus Kidney	Fluid Human Lung Fibroblasts	Suckling Mice	Agar overlay Rhesus kidney	Virus Type
115332	Spinal cord	+	-	-	+(4 plaques)*	Poliovirus 1
115332	Medulla	+	-	-	+(10 plaques)	Poliovirus 1
115332	Cortex	-	-	-	-	None
115371	Vermis	-	-	-	+(2 plaques)	Poliovirus 1
115371	Cortex	-	-	-	-	None
115371	Spinal cord	+	+	-	+(10 plaques)	Poliovirus 1
115371	Medulla	-	+(second passage)	-	+(3 plaques)	Poliovirus 1

*Number plaques per 0.2 ml inoculum.

In summary, a total of 47 GDVL-TRVL virus isolants were confirmed as poliovirus type 1 (15 in Trinidad, 32 in Atlanta). Of these 47 cases, 31 had no history of recent polio vaccination, 8 gave a history of vaccination within one month, and 8 had an unknown vaccination history. The significance of the isolation of poliovirus type 1 from the 8 cases with a history of vaccination within one month is uncertain, since vaccine virus might have persisted in these patients for this length of time. In the 31 cases without a history of recent vaccination, however, the isolation of poliovirus type 1 can be considered a valid indication of the poliovirus type involved in the illnesses. One poliovirus type 2 isolant was also confirmed in Trinidad. In only 3 instances were there differences between the TRVL and CDC findings on tissue culture isolants. Ten of twelve original isolations from rectal swabs were repeated and confirmed as poliovirus type 1. Two of these 10 cases had a history of polio vaccination within 1 month, 6 had no history of recent vaccination, and 2 had an unknown vaccination history. The significance of the isolation of poliovirus type 1 from the 2 cases with a history of recent vaccination is again uncertain. Isolation of poliovirus type 1 from the 6 cases without a history of recent vaccination, on the other hand, again indicates the poliovirus type involved in the outbreak. Poliovirus type 1 was isolated from central nervous system tissues of two fatal cases (isolation done both in Trinidad and Atlanta). Neither of these 2 cases had a history of recent polio vaccination. Overall, then, the virological findings show that the outbreak of poliomyelitis was due to poliovirus type 1. There was excellent agreement between the virological results of the two laboratories using independent reagents and methods.

ADDITIONAL STUDIES

Seventy-nine rectal swabs were collected before vaccination at two health centers (Barataria and Santa Cruz) from children 6 months to 12 years of age. Viral isolation studies at TRVL revealed poliovirus type 1 in 3 of these children.

One hundred three blood samples were collected at the same two health centers on children before vaccination. Other blood samples were made available by TRVL as follows:

(a) Santa Cruz area -- 32 pairs (First serum collected previously for TRVL studies, second collected during 1971-72 poliomyelitis outbreak)

(b) Vega de Oropouche, Plum Mitan, Plum Road, Grosvenor, Tabaquite and Caparo schools -- 48 pairs (First and second sera collected as above).

(c) From areas (a) and (b) -- 78 single sera (collected during 1971-72 poliomyelitis outbreak).

(d) Stephens Clinic, St. James Health Center - 36 single sera (collected before vaccination at these health centers).

Poliovirus antibody studies are planned on these sera to gather further data concerning pre-vaccination antibody status of children in Trinidad.

PROBLEMS CONCERNING USE OF ORAL POLIOVACCINE

Numerous questions were raised about the storage and use of oral poliovaccine. Principal among these were how long the vaccine would remain usable if stored refrigerated rather than frozen, how many times unopened vials of vaccine could be thawed and refrozen, and how long the remaining contents of an opened vial could be used. A set of recommendations was provided to the Ministry of Health covering these points (see Annex II). The recommendations were based on those given by American producers of vaccine and should, if adhered to, maintain potency of the vaccine. Other questions frequently raised concerned the use of oral poliovaccine in pregnant women and in the presence of other infections (respiratory illness or diarrhea, mainly). No written recommendations covering these points were prepared. Some general guidelines available in writing would probably be useful in similar situations.

CONCLUSIONS

1. Virological studies clearly indicated that the poliomyelitis epidemic was due to type 1 poliovirus.

2. Storage facilities provided for oral poliovaccine by the Ministry of Health were less than optimal. Similarly, storage facilities in the outlying health centers need to be improved.

3. There is a need for obtaining and disseminating information concerning storage and use of oral poliovaccine, both within the Ministry of Health and to private physicians.

RECOMMENDATIONS TO THE GOVERNMENT OF TRINIDAD AND TOBAGO

1. The Ministry of Health should establish a recommended set of conditions for storage and handling of oral poliovaccine which will maintain the potency of the vaccine. These directions should be provided to all the outlying health centers.

2. The Ministry of Health should obtain and disseminate information concerning the recommended use of oral poliovaccine. Such questions as those concerning use in pregnant women, use in the presence of intercurrent infection, and use in those already having had Salk vaccine should be covered in this information.

3. The Ministry of Health should maintain its own facilities for storage of oral poliovaccine in the frozen state. Sufficient freezer space should be available at the main distribution center so that oral poliovaccine need not be sitting in cartons with dry ice while awaiting transportation to outlying areas.

4. As soon as possible, the health centers should be provided with refrigerators having a freezer compartment with a separate door. In general, the freezer compartments of such refrigerators maintain better freezing conditions than freezer sections located within the refrigerator compartment itself.

5. The Ministry of Health should carry out spot checks on storage of oral poliovaccine in the various health centers to determine whether the vaccine is being maintained frozen. Each health center should be required to keep an inventory of vaccine to include the date received. In this way, if storage facilities in any health center are not adequate to maintain poliovaccine frozen, the length of storage time in the liquid, refrigerated state could be controlled.

6. The Ministry of Health should check commercial sources of oral poliovaccine to be sure that the vaccine supplied to private physicians is kept frozen before distribution. Physicians should also be informed of the proper storage conditions for and time limitations on the use of oral poliovaccine.

7. Close liason should be maintained between the Ministry of Health and the Government Diagnostic Virus Laboratory - Trinidad Regional Virus Laboratory complex. Poliovirus isolation and typing facilities appear to be excellent at GDVL-TRVL. An increase in the number of poliovirus isolations should be followed closely to determine whether particular public health measures (for example, intensified immunization) are necessary.

8. Laboratory studies to determine the antibody response after poliovirus immunization are recommended. These might give some indication of the

effectiveness of the immunization program, as well as suggesting problem areas (possible improper handling of vaccine, diminished seroconversion rate sometimes seen in tropical areas).

RECOMMENDATIONS TO THE PAN AMERICAN HEALTH ORGANIZATION

1. The Pan American Health Organization should publish recommendations concerning the handling and storage of oral poliovaccine. Confusion exists because various producers of vaccine differ in their recommendations. American producers (i. e., Lederle) recommend storage of oral poliovaccine for no more than 30 days in the liquid, refrigerated state (8°C or lower). Canadian producers (i. e., Connaught) indicate that vaccine can be kept for 90 days in the liquid, refrigerated state (4°C or lower). A practical recommendation, taking into account the fact that refrigeration facilities of unknown temperatures will be used in the field, should be issued. American producers of oral vaccine indicate that vials, once opened, must be used within 7 days (stored at 8°C or lower). Connaught does not give any recommendation concerning use of opened vials. A French producer (Institut Merieux) says that "every vial which has been opened must be used on the same day." Again, a practical recommendation is needed.

2. The Pan American Health Organization should provide recommendations concerning the use of oral poliovaccine. American producers of vaccine say that "pregnancy of itself is not a contraindication when immunization is required." Canadian producers, in contrast, advise that "for pregnant women at any age inactivated poliomyelitis vaccine is recommended for primary immunization before administration of trivalent Sabin vaccine." Some resolution of this difference in recommendations should be provided. The question of whether the presence of another infection (diarrhea, upper respiratory illness) constitutes a contraindication to the administration of oral poliovaccine should be discussed. American producers of vaccine are fairly specific on their recommendations in such instances (i. e., postpone if there is persistent diarrhea or any acute illness, give if only minor upper respiratory infection is present). Definite guidelines should be provided for an epidemic situation. Another recurrent question in an epidemic situation is that of whether adults need to be immunized. Specific recommendations should be available. If monovalent poliovaccine is used in attempting to stem an epidemic, recommendations concerning the type of vaccine to use in follow-up immunizations should be provided.

3. The Pan American Health Organization should consider recommending the establishment of a regional storage facility for oral poliovaccine. Such a facility should stock both monovalent and trivalent vaccines. A virological laboratory should be associated with the storage facility to provide a check for potency on vaccines in stock. This laboratory could also provide poliovirus isolation and identification services to those countries needing this type of assistance.

4. The Pan American Health Organization should provide assistance in getting fresh supplies of tissue culture and other materials to any consultant virologist sent to aid in studying a poliomyelitis outbreak. If

an existing laboratory is carrying out viral studies in relation to the epidemic, the Pan American Health Organization might consider providing assistance to this laboratory in manpower and supplies.

ANNEX I

COOPERATION RECEIVED FROM INDIVIDUALS AND ORGANIZATIONS

Dr. Pierre Ardoin, Chief, Trinidad Regional Virus Laboratory

Miss Barbara Hull, Trinidad Regional Virus Laboratory

Mr. Harold Drysdale, Government Virus Diagnostic Laboratory

Nurse Bishop, Trinidad Regional Virus Laboratory

Dr. Mervyn Henry, Ministry of Health, Trinidad and Tobago

Dr. J. Monrose, Ministry of Health, Trinidad and Tobago

Dr. Oswald Siung, Ministry of Health, Trinidad and Tobago

ANNEX II

MINISTRY OF HEALTH

GOVERNMENT OF TRINIDAD AND TOBAGO

RECOMMENDATIONS FOR STORAGE OF ORAL POLIOVIRUS VACCINE

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1. Bulk vaccine should be stored frozen as close to -20°C as possible. Under these conditions, the vaccine retains potency to the expiration date indicated on the containers.

2. Vaccine kept in the liquid state under refrigeration (no higher than 8°C) should be used within 30 days. This is the recommendation of American producers of vaccine and is intended to assure potency of vaccine kept under refrigeration.

3. Unopened vials of vaccine may be thawed and refrozen a maximum of 10 times if the temperature while thawed does not exceed 8°C and if the total cumulative duration of thaw does not exceed 24 hours. If the 24-hour period is exceeded, the vaccine must be used within 30 days during which time it should be stored in the refrigerator at a temperature no higher than 8°C. Thus, unopened vials of vaccine not used on one day of a vaccination campaign should be refrozen for later use. When the total cumulative period of thaw is more than 24 hours, the vaccine must be used within 30 days.

4. Vials of vaccine which have been opened must be used within 7 days during which time it should be stored in the refrigerator at a temperature no higher than 8°C. If the color of the vaccine in an opened vial changes from red or pink to yellow, the vial should be discarded because bacterial contamination may be indicated by the color change.

5. Frozen vaccine must be agitated (shaken) after thawing to ensure uniform distribution of virus in the liquid.

ANNEX III

VIROLOGICAL METHODS USED

1. Rapid procedure for simultaneous isolation and identification of polioviruses.

   A. Prepare suspension from rectal swab; centrifuge and treat with antibiotics (penicillin, streptomycin, neomycin, amphotericin B).

   B. Mix a portion of the suspension with an equal volume of:

      a. Pool of poliovirus 1, 2, and 3 antibodies (50 units each antibody)
      b. Poliovirus type 1 antibody (50 units)
      c. Poliovirus type 2 antibody (50 units)
      d. Poliovirus type 3 antibody (50 units)

   C. Incubate 1-2 hours at room temperature.

   D. Inoculate 2 tubes of rhesus monkey kidney cells each with 0.2 ml samples of above rectal swab suspensions, antibody mixtures.

   E. Incubate tubes at 36° and observe microscopically for cytopathic effect.

	EXPECTED RESULT IN PRESENCE OF ANTIBODIES AGAINST:			
Virus type indicated	Poliovirus 1	Poliovirus 2	Poliovirus 3	All 3 Polioviruses
Poliovirus 1	- CPE*	+ CPE	+ CPE	- CPE
Poliovirus 2	+ CPE	- CPE	+ CPE	- CPE
Poliovirus 3	+ CPE	+ CPE	- CPE	- CPE
Mixure of polioviruses	+ CPE	+ CPE	+ CPE	- CPE
Other enterovirus	+ CPE	+ CPE	+ CPE	+ CPE
No virus present	- CPE	- CPE	- CPE	- CPE

* Cytopathic effect

2. Standard procedure for isolation and typing of enteroviruses (including polioviruses)

A. Prepare suspensions from rectal or throat swabs in tissue culture maintenance medium.
B. Centrifuge 45 minutes at 8000 rpm in cold.
C. Add antibiotics (penicillin, streptomycin, neomycin, amphotericin B); let stand 1 hour at room temperature.
D. Inoculate primary rhesus kidney and diploid human embryonic lung tissue cultures and suckling mice.
E. Incubate, observe for cytopathic effect in tissue culture or paralysis or death in suckling mice.
F. If virus is found, titrate in appropriate system.
G. Set up neutralization tests with 100 $TCID_{50}$ (100 LD_{50} in mice) against known antisera (pools of antisera followed by indicated individual antisera; 20 antibody units for each antiserum). Titrate virus dilution used in test to check on dose of virus used.

3. Neutralization tests for poliovirus antibodies in patients' sera.

A. Inactive sera 30 minutes at 56°C.

B. Prepare dilutions in tissue culture maintenance fluid (1:8).

C. Add previously titrated stock polioviruses (100 $TCID_{50}$ per 0.1 ml for each 0.1 ml serum dilution).

D. Incubate 1 hour at room temperature.

E. Inoculate two tissue culture tubes (HEp-2) with 0.2 ml each serum-virus mixture.

F. Incubate at 35° for 6-8 days, observing for neutralization of cytopathic effect.

G. Titrate virus dilution used in test to check on dose of virus used.